Intimate partner violence and HIV in ten sub-Saharan African countries: what do the Demographic and Health Surveys tell us?

Dick Durevall, Annika Lindskog

Summary

Background Many studies have identified a significant positive relation between intimate partner violence and HIV in women, but adjusted analyses have produced inconsistent results. We systematically assessed the association, and under what condition it holds, using nationally representative data from ten sub-Saharan African countries, focusing on physical, sexual, and emotional violence, and on the role of male controlling behaviour.

Methods We assessed cross-sectional data from 12 Demographic and Health Surveys from ten countries in sub-Saharan Africa. The data are nationally representative for women aged 15–49 years. We estimated odds ratios using logistic regression with and without controls for demographic and socioeconomic factors and survey–region fixed effects. Exposure was measured using physical, sexual, emotional violence, and male controlling behaviour, and combinations of these. The samples used were ever-married women, married women, and women in their first union. Depending on specification, the sample size varied between 11 231 and 45 550 women.

Findings There were consistent and strong associations between HIV infection in women and physical violence, emotional violence, and male controlling behaviour (adjusted odds ratios ranged from 1·2 to 1·7; p values ranged from <0·0001 to 0·0058). The evidence for an association between sexual violence and HIV was weaker and only significant in the sample with women in their first union. The associations were dependent on the presence of controlling behaviour and a high regional HIV prevalence rate; when women were exposed to only physical, sexual, or emotional violence, and no controlling behaviour, or when HIV prevalence rates are lower than 5%, the adjusted odds ratios were, in general, close to 1 and insignificant.

Interpretation The findings indicate that male controlling behaviour in its own right, or as an indicator of ongoing or severe violence, puts women at risk of HIV infection. HIV prevention interventions should focus on high-prevalence areas and men with controlling behaviour, in addition to violence.

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Department of Economics and Gothenburg Centre of Globalization and Development, University of Gothenburg, Gothenburg, Sweden (Prof D Durevall PhD, A Lindskog PhD)

Correspondence to: Dr Annika Lindskog, Department of Economics, School of Business, Economics and Law, University of Gothenburg, PO Box 640, SE 405 30, Gothenburg, Sweden **annika.lindskog@economics.gu.se**

Introduction

According to the UNAIDS World AIDS Day Report 2011,[1] one in seven new HIV infections in South Africa could have been avoided through the prevention of intimate partner violence. The statement is based on Jewkes and colleagues' longitudinal study[2] of young women in South Africa in 2002–06. Several other studies also show an association between intimate partner violence and HIV infection in women, and a recent report from WHO and UNAIDS[3] concludes that research documents an undeniable link between intimate partner violence and HIV infection.

However, a multicountry study[4] with nationally representative data not only questions whether intimate partner violence causes HIV but even suggests that no association exists. The study used six Demographic and Health Surveys (DHS) from sub-Saharan Africa and three from other developing countries (Dominican Republic, Haiti, and India). Additionally, a recent literature survey[5] concluded that, although several studies report a positive and statistically significant association between exposure to intimate partner violence and HIV infection, the findings are inconsistent and the type of intimate partner violence that is related to HIV remains unclear.

The aim of this report is to analyse systematically the association between HIV and intimate partner violence with use of all sub-Saharan African DHS datasets available in early 2014, and to assess under what conditions the association is recorded. Our exposures of intimate partner violence are binary indicators of physical, sexual, and emotional violence (denoted "violence" for simplicity), male controlling behaviour, and combinations of these. Most studies focus on some of these factors, mostly physical and sexual violence, and only one study that used DHS data analysed controlling behaviour,[6] although such behaviour is viewed as one type of intimate partner violence.[7]

Controlling behaviour is likely to be important both in its own right and as a proxy for severity of violence. However, it often occurs in combination with physical or sexual violence that is ongoing and unlikely to stop.[8] Violence in combination with controlling behaviour has been termed coercive controlling violence, to distinguish it from situational couple violence that results from conflicts between partners that occasionally escalate into violence.[9] Coercive controlling violence is likely to result in frequent abuse and severe injuries, whereas situational couple violence is more common but is probably not related to male dominance since often both men and women are aggressors. If the distinction between coercive controlling violence and situational couple violence matters, measures of intimate partner violence that ignore controlling behaviour might be only weakly associated with HIV. We use a narrow measure of controlling behaviour: positive responses to questions about whether the husband does not allow his wife to meet her girlfriends or tries to limit her contact with family. Our hypothesis was that an association exists between intimate partner violence and HIV, and that this association is stronger when violence is combined with controlling behaviour.

By contrast with earlier studies that used DHS data, we ensure that comparison groups are clean—ie, women in the comparison groups do not report being exposed to any of the four types of intimate partner violence. If a woman does not belong to the clean comparison group, and is not exposed to the type of violence under consideration in the estimation, we exclude her from the sample. Earlier studies analysed whether women exposed to one type of intimate partner violence are more likely to be HIV positive than are a comparison group of women that includes those who might have been exposed to another type of intimate partner violence (ie, the comparison group is not clean).

The samples of women used in earlier studies based on DHS data vary between ever-married women,[4] married women,[4,6,10] and women who are in their first union and do not report any premarital sex or extramarital sex within the previous 12 months.[11] Arguments both for and against any of the three choices exist: many ever-married women could have been infected by HIV after divorce or during widowhood, or they might have divorced a violent husband who infected them; and faithful women in their first union are least likely to have been infected outside marriage, but premarital or extramarital sex might be misreported. We aimed to compare the three sample groups systematically.

See Online for appendix

HIV prevalence varies greatly across countries and regions in sub-Saharan Africa, from lower than 1% (eg, in rural Mali) to more than 20% (eg, in urban Zimbabwe) in adults in our sample. As is evident from the potential mechanisms generating the association between intimate partner violence and HIV, the association might be stronger in societies with a high prevalence of HIV. Three fundamental, potentially important, mechanisms for this association exist:[12] violent men are more likely than non-violent men to become infected by HIV outside their marriage; women exposed to intimate partner violence are more likely to be infected outside their marriage than are those not exposed to such violence (either because her risky behaviour triggers intimate partner violence, or because intimate partner violence leads to reduced self-esteem and increased risky sexual behaviour); and intimate partner violence increases the risk of HIV transmission between partners because of unwanted sex and less condom use, including coercion and subsequent genital trauma. If the first two mechanisms are important, prevalence should matter, whereas it should not be of major significance for the association if increased transmission risk within marriage is the clearly dominant mechanism. Therefore, we explore how the associations vary across regions with high and low levels of HIV prevalence.

Methods

Data collection

We used cross-sectional DHS data from 12 surveys in ten countries: one each from Burkina Faso (2010), Côte d'Ivoire (2011/12), Gabon (2011), Kenya (2008), Liberia (2006), Mali (2007), Rwanda (2005), and Zambia (2007), and two from Malawi (2004 and 2010), and Zimbabwe (2005/06 and 2010/11). These datasets comprise all African DHS data available in early 2014 that included HIV testing and a complete domestic violence module and that allow us to link HIV and intimate partner violence (ie, by asking the same women questions about both). We did not use four surveys with data for HIV and intimate partner violence because of missing information: emotional violence is missing in Rwanda 2010; controlling behaviour is missing in Kenya 2003 and Rwanda 2010; and, in Cameroon 2011, information about HIV and intimate partner violence was gathered from different subgroups of women. The DHS data are nationally representative for women 15–49 years of age. The surveys are stratified by country-specific administrative and geographical regions. Detailed information about survey design, sampling methods, and refusal rates is available in the DHS final survey reports.[13] Of the eligible sample, typically more than 90% participated in the survey. The response rate for the intimate partner violence module was higher than 98% in most surveys; the exception is Rwanda 2005, in which it was 89%. The response rate for HIV testing varied between 76% and 99%. Appendix p 1 provides information about missing observations and an analysis of likely biases.

Outcome and exposure

The HIV outcome is a binary variable indicating HIV infection status (ie, positive or negative). Blood spot samples were collected from every individual in the same random subset of households where men were eligible for interviews, on a fully informed and voluntary basis. The

blood samples were first analysed with an ELISA test, then all positive samples and 10% of the negative ones were retested with ELISA. For discordant samples, a Western blot test was finally used.[14]

Exposure to intimate partner violence is measured by binary (ie, yes or no) indicators of physical, sexual, and emotional violence, controlling behaviour, and combinations of these. Information about intimate partner violence was collected from one randomly selected woman in each household, with no-one else in the household aware that this was done. Married or cohabiting women were asked about ever having experienced intimate partner violence by their husband or partner, whereas formerly married or formerly cohabiting women were asked about intimate partner violence by their most recent husband or partner. The violence module used is a modified and abbreviated version of the Conflict Tactics Scale,[15] in which the questions ask about specific acts (eg, does/did your husband ever slap you, punch you with his fist, twist your arm, etc), which are classified as physical, emotional, or sexual violence (see appendix pp 4–5 for details). If the woman answered yes to at least one of the questions related to physical, sexual, or emotional violence, the relevant violence indicator was coded as 1; if she answered no to all questions in the set, it was coded 0.

Women were also asked specific questions about marital control exercised by their current husband (or their most recent husband if they were widowed or divorced), such as whether he is jealous or angry if she talks to other men, or whether or not he allows her to meet her female friends. Controlling behaviour was defined as at least one positive response to questions about whether the husband does not permit her to meet her girlfriends or tries to limit her contact with her family. Although jealousy and accusations of infidelity are likely to be common traits in controlling men, this information was not used because it could also be related to the woman's infidelity, which itself could be a trigger of intimate partner violence. Jealousy and suspicions of infidelity are reported two to three times more often by the women in our sample than are attempts to limit contact with female friends and family. For the sample of ever-married women, the Spearman's rank correlation coefficients between jealousy or infidelity and restrictions on seeing female friends or family range from 0·20 to 0·35, depending on the sample group, so the indicator we used is measuring something other than jealousy or suspicion of infidelity.

In addition to the individual indicators of physical, sexual, and emotional violence and controlling behaviour, we combined indicators to assess the importance of male controlling behaviour: any violence (physical, sexual, or emotional) or controlling behaviour; any violence but no controlling behaviour; controlling behaviour but no violence; any violence plus controlling behaviour; physical violence but no controlling behaviour; sexual violence but no controlling behaviour; and emotional violence but no controlling behaviour.

We also used an indicator that combines physical or sexual violence, which was also used in Harling and colleagues' study[4]—the most comprehensive previous study of national data from African countries. To help comparisons with their results, we estimated models with this indicator with both a clean comparison group and a comparison group that includes women exposed to emotional violence or control, in addition to those who have not been exposed to any intimate partner violence. Details about the coding of each indicator can be found in appendix pp 4–5.

Covariates

The covariates used in this report are standard and similar to the ones used in the multicountry study by Harling and colleagues,[4] with the exception of lifetime number of sex partners, which was excluded from our study because it could be a mediating factor. The covariates are age, education, occupation, religion, wealth quintile, and urban residence. Estimations with all ever-married women also included a marital status indicator. In pooled sample estimations, we used survey-specific dummies for within-country regions because HIV rates vary geographically and over time; Harling and colleagues[4] used country dummies.

Statistical analysis

We estimated bivariate and multivariate logistic models using pooled samples and samples from each survey, varying the exposure indicator and keeping the reference group "clean"—ie, the estimation sample only includes women exposed to intimate partner violence as measured in that model and a control group of women who were not exposed to any form of intimate partner violence.

We estimated models using ever-married women, married women, and women who are currently in their first union and do not report any premarital or extramarital sex during the previous 12 months. Importantly, these samples are not mutually exclusive. Samples also vary depending on the intimate partner violence indicator used. Although the clean comparison group is always the same, the group of women subjected to intimate partner violence differs depending on the type of violence. Furthermore, to show the importance of regional HIV prevalence in explaining the link between intimate partner violence and HIV, samples were split into subnational regions with HIV prevalence higher than 5% and those with rates below 5%, which is roughly the average prevalence in sub-Saharan Africa. These results are presented in appendix pp 11–12.

Standard errors are clustered at the region–survey level by use of the Eicker-Huber-White robust variance estimator, which assumes independence across groups but allows any type of within-group correlation. We followed Harling and colleagues' approach[4] and did not use weights in the main estimations because their effects are unclear when subsamples are used. We used Stata version 13.0 for all analyses.

Role of the funding source
The funders of the study had no role in study design, data collection, data interpretation, data analysis, writing of the report, or the decision to submit for publication. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

Table 1 shows the pooled sample size and percentage distribution by outcome, exposure, and covariates for all ever-married women. In total, 39 000 observations with non-missing data for all variables are listed. Almost 40% of these women report having been exposed to some form of intimate partner violence (termed "any violence"). This percentage varies in the country surveys from 26% in Burkina Faso to 63% in Zambia (appendix p 6). Physical violence is the most common type (29%), followed by emotional violence (23%), whereas sexual violence is less frequent (12%). Although controlling behaviour is defined narrowly, as many as 22% of women report having been exposed to it. The prevalence of HIV infection is 14–16% in the women who report intimate partner violence and 10% in those who report no violence (table 1).

The distribution of HIV prevalence across the other covariates is in line with findings in previous studies: it increases with age until 40 years (and then declines) and also increases with rising wealth and education; it is much higher among formerly married women (ie, those who are widowed or divorced) than in currently married women; and it is higher in urban than rural areas (table 1).

Table 2 reports unadjusted and adjusted odds ratios based on pooled regressions for 13 measures of intimate partner violence and the three samples: ever-married women; married women; and women in their first marriage who do not report premarital or extramarital sex. All the unadjusted odds ratios are higher than 1 and nearly all are significant. The adjusted odds ratios are also higher than 1 and many, but not all, are significant. Physical violence, emotional violence, and controlling behaviour as individual factors are associated with an

	Women, n (%)	HIV-positive women, n (%)
Age group (years)		
15–19	2469 (6·3%)	118 (4·8%)
20–24	7806 (20·0%)	595 (7·6%)
25–29	8765 (22·5%)	1029 (11·7%)
30–34	7303 (18·7%)	1079 (14·8%)
35–39	5397 (13·8%)	792 (14·7%)
40–44	3961 (10·2%)	505 (12·7%)
45–49	3299 (8·5%)	341 (10·3%)
Marital status		
Currently married	34 497 (88·5%)	3098 (9·0%)
Formerly married	4503 (11·5%)	1361 (30·2%)
Urbanicity		
Rural	28 254 (72·4%)	2884 (10·2%)
Urban	10 746 (27·6%)	1575 (14·7%)
Wealth quintiles		
Poorest	8860 (22·7%)	794 (9·0%)
Poorer	8238 (21·1%)	829 (10·1%)
Middle	7812 (20·0%)	859 (11·0%)
Richer	7918 (20·3%)	1092 (13·8%)
Richest	6172 (15·8%)	885 (14·3%)
Education		
No education	12 731 (32·6%)	544 (4·3%)
Primary	16 040 (41·1%)	2084 (13·0%)
Secondary or higher	10 229 (26·2%)	1831 (17·9%)
Employment		
Not employed	13 062 (33·5%)	1779 (13·6%)
Agricultural	13 351 (34·2%)	979 (7·3%)
Manual	2238 (5·7%)	325 (14·5%)
Other	10 349 (26·5%)	1376 (13·3%)
Religion		
Christian	28 067 (72·0%)	3870 (13·8%)
Muslim	8383 (21·5%)	314 (3·7%)
Other religion	2550 (6·5%)	275 (10·8%)
(Table 1 continues on next column)		
(Continued from previous column)		
Violence		
Any violence	15 204 (39·0%)	2078 (13·7%)
Physical violence	11 188 (28·7%)	1542 (13·8%)
Sexual violence	4608 (11·8%)	714 (15·5%)
Emotional violence	9043 (23·2%)	1317 (14·6%)
Controlling behaviour	8730 (22·4%)	1155 (13·2%)
No violence or controlling behaviour	20 376 (52·2%)	2023 (9·9%)
Country		
Burkina Faso, 2010	4834 (12·4%)	65 (1·3%)
Côte d'Ivoire, 2011/12	2268 (5·8%)	108 (4·8%)
Gabon, 2011	2681 (6·9%)	193 (7·2%)
Kenya, 2008	2195 (5·6%)	233 (10·6%)
Liberia 2006	2617 (6·7%)	59 (2·3%)
Mali, 2007	2746 (7·0%)	44 (1·6%)
Malawi, 2004	2082 (5·3%)	327 (15·7%)
Malawi, 2010	5020 (3·9%)	687 (13·7%)
Rwanda, 2005	2476 (6·3%)	82 (3·3%)
Zambia, 2007	3384 (8·7%)	609 (18·0%)
Zimbabwe, 2005/06	4154 (10·7%)	1034 (24·9%)
Zimbabwe, 2010/11	4543 (11·6%)	1018 (22·4%)
Total	39 000 (100·0%)	4459 (11·4%)

The sample in this table is ever-married women for whom complete information was available.

Table 1: **Pooled sample size and percentage distribution by exposure and covariates**

increased risk of HIV infection in all three sample groups, with adjusted odds ratios ranging from 1·12 to 1·42 and p values ranging from less than 0·0001 to 0·0058, whereas sexual violence is insignificant (according to adjusted odds ratios) in the samples of ever-married and married women but significant in the sample of women in their first marriage (p=0·0361).

The combined indicators that include controlling behaviour all have statistically significant adjusted odds ratios, whereas the association is much weaker when no controlling behaviour is involved. For example, the adjusted odds ratios for control and no violence for the three samples are 1·21 (95% CI 1·05–1·39) for ever-married women, 1·25 (1·08–1·45) for married women, and 1·31

	Ever-married women				Married women				Women in their first union with no premarital or extramarital sex			
	Unadjusted n	Unadjusted OR (95% CI)	Adjusted n	Adjusted OR (95% CI)	Unadjusted n	Unadjusted OR (95% CI)	Adjusted n	Adjusted OR (95% CI)	Unadjusted n	Unadjusted OR (95% CI)	Adjusted n	Adjusted OR (95% CI)
Physical violence	32 495	1·424* (1·236–1·641)	31 072	1·133 (1·037–1·237)	28 784	1·375* (1·168–1·619)	27 475	1·222* (1·096–1·363)	16 638	1·686* (1·432–1·986)	15 283	1·423* (1·232–1·643)
Sexual violence	25 583	1·653* (1·383–1·976)	24 432	1·077 (0·960–1·209)	22 900	1·512* (1·232–1·857)	21 691	1·136 (0·976–1·322)	13 531	1·739* (1·342–2·253)	12 136	1·239† (1·014–1·514)
Emotional violence	30 318	1·512* (1·286–1·777)	29 073	1·122‡ (1·034–1·218)	26 866	1·498* (1·249–1·796)	25 716	1·243* (1·120–1·380)	15 447	1·659* (1·348–2·042)	13 854	1·222‡ (1·070–1·394)
Controlling behaviour	29 977	1·354* (1·172–1·564)	28 718	1·201* (1·102–1·308)	26 686	1·328* (1·122–1·573)	25 196	1·351* (1·222–1·494)	15 337	1·534* (1·246–1·889)	14 111	1·407* (1·215–1·629)
Controlling behaviour and emotional violence	24 773	1·687* (1·399–2·035)	23 664	1·215* (1·084–1·361)	22 099	1·675* (1·351–2·077)	20 782	1·507* (1·308–1·735)	12 903	1·862* (1·451–2·390)	11 322	1·380* (1·147–1·662)
Violence or controlling behaviour	40 179	1·344* (1·188–1·521)	38 589	1·104‡ (1·026–1·188)	35 559	1·311* (1·133–1·516)	34 101	1·163‡ (1·062–1·272)	20 275	1·518* (1·298–1·775)	19 168	1·253* (1·127–1·393)
Violence and controlling behaviour	26 431	1·564* (1·317–1·856)	25 253	1·192‡ (1·071–1·326)	23 505	1·530* (1·263–1·855)	22 117	1·412* (1·238–1·609)	13 612	1·858* (1·463–2·360)	12 163	1·493* (1·221–1·827)
Controlling behaviour and no violence	24 406	1·040 (0·867–1·248)	23 282	1·208‡ (1·054–1·386)	22 295	1·059 (0·840–1·335)	20 952	1·247‡ (1·075–1·446)	13 229	1·154 (0·881–1·512)	11 726	1·306‡ (1·075–1·588)
Violence and no controlling behaviour	31 062	1·336* (1·161–1·538)	29 919	1·032 (0·939–1·134)	27 987	1·296‡ (1·096–1·532)	26 924	1·042 (0·929–1·169)	16 442	1·505* (1·262–1·794)	14 954	1·150† (1·015–1·302)
Physical violence and no controlling behaviour	28 087	1·339* (1·170–1·534)	26 898	1·093 (0·988–1·209)	25 360	1·291‡ (1·100–1·516)	24 252	1·112 (0·986–1·253)	14 986	1·550* (1·331–1·804)	13 572	1·318* (1·129–1·539)
Sexual violence and no controlling behaviour	23 538	1·499* (1·233–1·823)	22 460	1·023 (0·888–1·179)	21 379	1·373‡ (1·087–1·734)	20 234	0·984 (0·812–1·193)	12 772	1·500‡ (1·119–2·012)	11 231	1·036 (0·812–1·322)
Emotional violence and no controlling behaviour	26 405	1·391* (1·161–1·667)	25 236	1·047 (0·944–1·162)	23 881	1·389‡ (1·135–1·700)	22 793	1·097 (0·969–1·242)	14 048	1·550* (1·227–1·958)	12 399	1·129 (0·976–1·306)
Physical or sexual violence (a)§	33 956	1·423* (1·238–1·635)	32 510	1·104† (1·010–1·208)	30 047	1·362* (1·157–1·603)	28 716	1·166‡ (1·042–1·305)	17 324	1·668* (1·413–1·969)	15 946	1·355* (1·180–1·557)
Physical or sexual violence (b)¶	45 550	1·263* (1·114–1·433)	43 820	1·054 (0·969–1·146)	40 247	1·201† (1·041–1·386)	38 652	1·089 (0·979–1·211)	23 642	1·458* (1·251–1·699)	22 414	1·309* (1·139–1·503)

The values in this table are based on logistic regressions. Regressions for the adjusted ORs are controlled for age, education, occupation, religion, wealth, urban residence, and survey–region dummies. Marital status is controlled for in the ever-married samples. The reference group is always women exposed to no violence of any type or to controlling behaviour. Women exposed to violence or controlling behaviour that was not captured by the exposure indicator were excluded from the estimation sample, except for physical or sexual (b), in which the sample includes women who report being exposed to emotional violence and controlling behaviour. Standard errors were clustered at the survey–region level. Note that estimation samples can be larger or smaller than the 39 000 women (table 1) because of differences in data availability. For estimation of adjusted ORs, the sample sizes are reduced because observations from subnational regions with no HIV-infected women are excluded from the regressions. OR=odds ratio. *p<0·001. †p<0·05. ‡p<0·01. §Clean comparison group. ¶Comparison group includes women exposed to emotional violence and control.

Table 2: **Risk of HIV infection in women exposed to intimate partner violence**

	Physical violence				Sexual violence				Emotional violence				Controlling behaviour			
	Un-adjusted n	Un-adjusted OR (95% CI)	Adjusted n	Adjusted OR (95% CI)	Un-adjusted n	Un-adjusted OR (95% CI)	Adjusted n	Adjusted OR (95% CI)	Un-adjusted n	Un-adjusted OR (95% CI)	Adjusted n	Adjusted OR (95% CI)	Un-adjusted n	Un-adjusted OR (95% CI)	Adjusted n	Adjusted OR (95% CI)
Burkina Faso, 2010	4060	1·384 (0·649–2·952)	4013	1·172 (0·529–2·597)	NA	NA	NA	NA	4068	1·536 (0·900–2·621)	4015	1·355 (0·826–2·222)	4139	1·201 (0·545–2·645)	4090	1·109 (0·563–2·185)
Côte d´Ivoire, 2011–12	1771	1·167 (0·560–2·433)	1761	1·100 (0·579–2·088)	1381	1·433 (0·564–3·642)	1374	1·316 (0·618–2·803)	1649	0·958 (0·446–2·056)	1641	0·848 (0·427–1·686)	1668	1·576 (0·921–2·698)	1660	1·395 (0·808–2·410)
Gabon, 2011	1837	0·804 (0·605–1·067)	1826	0·823 (0·587–1·153)	1061	1·014 (0·679–1·513)	1052	1·015 (0·644–1·601)	1522	0·785 (0·552–1·117)	1510	0·786 (0·549–1·125)	1692	0·919 (0·604–1·398)	1679	0·892 (0·595–1·338)
Kenya, 2008	1582	2·004* (1·020–3·937)	1449	1·776 (0·692–4·558)	1177	2·115* (1·032–4·335)	1097	1·319 (0·475–3·663)	1453	1·783* (1·013–3·137)	1450	1·387 (0·647–2·973)	1344	1·541 (0·786–3·022)	1151	1·223 (0·481–3·110)
Liberia, 2006	2463	1·022 (0·481–2·170)	1795	1·043 (0·533–2·044)	1627	0·827 (0·374–1·828)	1208	1·325 (0·587–2·988)	2470	1·189 (0·555–2·545]	1800	1·082 (0·616–1·900)	2283	1·274 (0·478–3·392)	1664	1·170 (0·522–2·621)
Mali, 2007	2097	1·302 (0·830–2·042)	1721	1·232 (0·653–2·323)	1757	2·120* (1·059–4·244)	1411	2·135 (0·857–5·315)	1920	0·486 (0·181–1·306)	1555	0·453 (0·123–1·666)	2386	0·772 (0·443–1·345)	1980	0·604* (0·379–0·963)
Malawi, 2004	1351	1·161 (0·613–2·198)	1346	1·297 (0·722–2·328)	1222	1·074 (0·475–2·429)	1216	1·448 (0·680–3·087)	1169	1·186 (0·456–3·082)	1164	1·307 (0·604–2·825)	1524	1·340 (0·879–2·043)	1519	1·477† (1·098–1·985)
Malawi, 2010	3416	1·036 (0·879–1·221)	3416	1·032 (0·894–1·192)	3234	0·781 (0·509–1·200)	3234	0·884 (0·579–1·348)	3606	0·942 (0·783–1·133)	3606	0·940 (0·754–1·171)	3117	1·030 (0·741–1·433)	3117	1·080 (0·871–1·339)
Rwanda, 2005	1994	1·048 (0·606–1·814)	1975	1·274 (0·667–2·433)	1546	1·538 (0·693–3·410)	1264	1·289 (0·550–3·023)	1492	2·073 (0·964–4·460)	1476	2·149 (0·950–4·859)	1708	1·481 (0·795–2·760)	1550	1·211 (0·623–2·353)
Zambia, 2007	2441	1·193 (0·859–1·657)	2434	1·072 (0·830–1·385)	1583	1·313 (0·785–2·194)	1577	1·164 (0·780–1·737)	1802	1·449* (1·087–1·932)	1796	1·216 (0·966–1·531)	1925	1·489† (1·145–1·937)	1920	1·383† (1·133–1·687)
Zimbabwe, 2005–06	2683	1·189 (0·920–1·537)	2673	1·299 (0·969–1·742)	2135	0·934 (0·684–1·276)	2128	1·076 (0·760–1·523)	2739	1·360‡ (1·158–1·598)	2730	1·467‡ (1·248–1·725)	2264	1·386‡ (1·207–1·591)	2254	1·536‡ (1·323–1·784)
Zimbabwe, 2010–11	3089	1·271* (1·020–1·585)	3066	1·375‡ (1·182–1·600)	2580	1·093 (0·788–1·515)	2562	1·185 (0·869–1·616)	2976	1·298† (1·078–1·563)	2954	1·349‡ (1·153–1·579)	2636	1·456‡ (1·205–1·760)	2612	1·614‡ (1·294–2·012)

The values in this table are based on logistic regressions. Regressions for the adjusted ORs are controlled for age, education, occupation, religion, wealth, and urban residence. Marital status is controlled for in the ever-married samples. The reference group is always women exposed to no violence of any type and to no male controlling behaviour. Women exposed to violence or control that was not captured by the exposure indicator were excluded from the estimation sample. Standard errors are clustered at the survey–region level. For estimation of adjusted ORs, the sample sizes are reduced because observations from subnational regions with no HIV-infected women are excluded from the regressions. OR=odds ratio. NA=not applicable (no variation in sample). *p<0·05. †p<0·01.‡p<0·001.

***Table 3*: Risk of HIV infection in married women exposed to intimate partner violence, by survey and type of violence**

(1·08–1·59) for women in their first marriage, whereas for any violence but no controlling behaviour these odd ratios are lower at 1·03 (95% CI 0·94–1·13), 1·04 (0·93–1·17), and 1·15 (1·02–1·30), respectively (table 2). Only one adjusted odds ratio is statistically significant for another indicator of intimate partner violence in which the women do not report experiencing male controlling behaviour: physical violence in the sample of women in their first union (table 2).

When physical and sexual violence are combined, as in Harling and colleagues' 2010 study,[4] and the control groups include women affected by emotional violence and controlling behaviour (ie, they are not clean), the adjusted odds ratios are insignificant and close to 1: 1·05 (95% CI 0·97–1·15) for ever-married women, and 1·09 (0·98–1·21) for married women. When a clean control group is used instead, the adjusted odds ratios are significant: 1·10 (95% CI 1·01–1·21) for ever-married women and 1·17 (1·04–1·31) for married women (table 2). In the sample of women in their first union, the adjusted odds ratio is greater than 1 and is significant in both models.

The association between intimate partner violence and HIV is noticeably weaker when the samples are limited to individual surveys, and many odds ratios are insignificant (tables 3, 4). The adjusted odds ratios in the samples with married women are significant and higher than 1 for physical violence in Zimbabwe 2010–11, for emotional

	Violence or controlling behaviour				Violence and no controlling behaviour				Controlling behaviour and violence				Controlling behaviour and no violence			
	Un-adjusted n	Un-adjusted OR (95% CI)	Adjusted n	Adjusted OR (95% CI)	Un-adjusted n	Un-adjusted OR (95% CI)	Adjusted n	Adjusted OR (95% CI)	Un-adjusted n	Un-adjusted OR (95% CI)	Adjusted n	Adjusted OR (95% CI)	Un-adjusted n	Un-adjusted OR (95% CI)	Adjusted n	Adjusted OR (95% CI)
Burkina Faso, 2010	4723	1·068 (0·644–1·770)	4661	0·918 (0·577–1·460)	4118	0·930 (0·327–2·644)	4067	0·696 (0·328–1·474)	3730	1·867 (0·608–5·733)	3688	1·648 (0·599–4·534)	3943	0·885 (0·349–2·246)	3898	0·843 (0·395–1·798)
Côte d´Ivoire, 2011–12	2104	1·291 (0·735–2·269)	2093	1·132 (0·667–1·922)	1722	1·046 (0·513–2·135)	1712	0·963 (0·520–1·783)	1474	1·297 (0·557–3·017)	1467	1·107 (0·522–2·348)	1480	1·852 (0·682–5·032)	1472	1·823 (0·620–5·360)
Kenya, 2008	1910	1·681 (0·972–2·905)	1906	1·432 (0·701–2·925)	1482	1·788* (1·050–3·045)	1478	1·405 (0·667–2·959)	1203	1·760 (0·752–4·119)	948	1·324 (0·434–4·036)	1057	1·110 (0·665–1·855)	891	0·830 (0·376–1·831)
Liberia, 2006	3193	1·112 (0·569–2·171)	2343	0·981 (0·547–1·757)	2249	0·945 (0·580–1·539)	1678	0·966 (0·386–2·416)	1962	1·473 (0·520–4·173)	1432	1·524 (0·718–3·236)	1660	0·892 (0·309–2·571)	1237	0·659 (0·214–2·031)
Mali, 2007	2735	0·925 (0·630–1·359)	2302	0·803 (0·571–1·130)	2017	1·244 (0·679–2·279)	1646	1·225 (0·551–2·723)	1868	0·926 (0·500–1·715)	1509	0·747 (0·410–1·363)	2186	0·712 (0·260–1·954)	1795	0·543 (0·210–1·402)
Malawi, 2004	1877	1·194 (0·792–1·800)	1871	1·355* (1·010–1·818)	1321	0·975 (0·589–1·614)	1315	1·154 (0·756–1·761)	1174	1·286 (0·407–4·066)	1169	1·516 (0·530–4·340)	1318	1·373 (0·940–2·004)	1313	1·452* (1·062–1·985)
Malawi, 2010	4277	0·897* (0·814–0·990)	4277	0·913 (0·809–1·030)	3742	0·837 (0·652–1·076)	3742	0·843 (0·640–1·109)	2953	1·041 (0·711–1·525)	2953	1·071 (0·799–1·436)	2746	1·006 (0·719–1·407)	2746	1·080 (0·997–1·170)
Rwanda, 2005		1·101 (0·643–1·885)	2269	1·123 (0·645–1·955)	1841	0·813 (0·468–1·410)	1823	0·981 (0·521–1·844)	1502	1·665 (0·839–3·308)	1356	1·427 (0·617–3·300)	1460	1·262 (0·596–2·675)	1187	1·051 (0·489–2·259)
Zambia, 2007	2889	1·221 (0·913–1·633)	2881	1·130 (0·916–1·394)	2095	1·014 (0·681–1·510)	2087	0·937 (0·681–1·291)	1687	1·436* (1·085–1·901)	1682	1·264* (1·004–1·590)	1369	1·615† (1·175–2·219)	1364	1·658‡ (1·273–2·158)
Zimbabwe, 2005–06	3426	1·178 (0·999–1·388)	3415	1·281† (1·074–1·528)	2828	1·076 (0·839–1·381)	2821	1·147 (0·864–1·524)	2101	1·547‡ (1·280–1·871)	2091	1·720‡ (1·427–2·075)	1829	0·995 (0·605–1·634)	1823	1·080 (0·634–1·842)
Zimbabwe, 2010–11	3806	1·209* (1·008–1·449)	3773	1·271† (1·086–1·488)	3190	1·086 (0·842–1·401)	3166	1·121 (0·893–1·408)	2455	1·484‡ (1·299–1·695)	2437	1·637‡ (1·388–1·930)	2201	1·392 (0·860–2·253)	2180	1·599 (0·939–2·723)

The values in this table are based on logistic regressions. Regressions for the adjusted ORs are controlled for age, education, occupation, religion, wealth, and urban residence. Marital status is controlled for in the ever-married samples. The reference group is always women exposed to no violence of any type and to no male controlling behaviour. Women exposed to violence or control that was not captured by the exposure indicator were excluded from the estimation sample. Standard errors were clustered at the survey–region level. For estimation of adjusted ORs, the sample sizes are reduced because observations from subnational regions with no HIV-infected women are excluded from the regressions. OR=odds ratio.*p<0·05. †p<0·01. ‡p<0·001.

Table 4: **Risk of HIV infection in married women exposed to intimate partner violence, by survey and combined measures of intimate partner violence**

violence in the two Zimbabwean surveys, and for controlling behaviour in Malawi 2004, Zambia 2007, and the two Zimbabwean surveys (table 3); the exception is controlling behaviour in Mali where the odds ratio is significant and lower than 1. The results are similar when indicators are combined, and, as when the data are pooled, violence without controlling behaviour has little effect (table 4). The results are also similar for ever-married women and women in their first union who do not report premarital or extramarital sex, although adjusted odds ratios for physical violence are significant in several surveys (appendix pp 7–10).

Because most of the significant odds ratios are in countries with a high prevalence of HIV (eg, Zimbabwe has the highest HIV prevalence of the included countries), we split the pooled sample into subnational regions with HIV rates higher than and lower than 5% to assess the role of HIV prevalence. In the sample with HIV prevalence higher than 5%, there are 56 regions, whereas in the sample with HIV prevalence lower than 5% there are 73 regions. Re-estimation of the models with HIV rates above 5% produces essentially the same results as previously, whereas, in regions with HIV rates lower than 5%, only four adjusted odds ratios are significantly higher than 1 (appendix pp 11–12).

Discussion

Our analysis of pooled DHS data from 12 surveys and ten sub-Saharan African countries confirms that reported intimate partner violence is associated with a significantly raised risk of HIV infection in women (panel). Depending on the exposure indicator, the sample (ever-married women, married women, and women in their first marriage who report no premarital or extramarital sex),

and regional HIV prevalence, the adjusted odds ratios range from 1·1 to 1·7, often with p values less than 0·0001.

The choice of exposure indicator has a substantial effect on the results. Male controlling behaviour and physical and emotional violence generally increase the probability of HIV infection, whereas sexual violence is significant only in the sample of women in their first union. Controlling behaviour has a key role: when any violence (physical, sexual, or emotional) is not combined with controlling behaviour, adjusted odds ratios generally do not differ significantly from 1. The differences between the adjusted odds ratios for violence that is not combined with controlling behaviour versus violence that is combined with controlling behaviour or controlling behaviour that is not combined with violence are statistically significant. Moreover, adjusted odds ratios for individual measures of physical, sexual, and emotional violence are not significant when women exposed to controlling behaviour are excluded, with one exception: physical violence in the sample of women in their first union. One interpretation of these results is that controlling behaviour combined with other types of intimate partner violence is a proxy for controlling coercive violence. Measures of violence without controlling behaviour should therefore to a large extent measure acts classified as situational couple violence. However, controlling behaviour might also conceivably capture severe violence, although the statistically significant odds ratios of controlling behaviour but no violence suggest that it measures other effects and it might be important in its own right. Independent of interpretation, our definition of controlling behaviour seems to have empirical relevance.

When individual surveys are analysed, many of the adjusted odds ratios are non-significant, although most of them are greater than 1 (table 3, appendix pp 7–10). Use of the sample weights provided by DHS does not affect the results much (appendix pp 13–14). The statistically significant associations between intimate partner violence and HIV tend to be recorded in regions with a high HIV prevalence; in particular, the association is strong for Zimbabwe, where more than 20% of married women are HIV positive. This finding suggests that the failure to find an association in many surveys could be related to the prevalence level, which is supported by the analysis of the sample split into subnational regions with HIV infection rates higher than and lower than 5% (appendix pp 11–12). Malawi, a country in which prevalence varies greatly across its three regions, provides a good example: testing the regions separately shows several significant associations in the southern region (where the HIV infection rate is 17·6%), but few in the central region (6·5%) and northern region (8·1%) (appendix p 15). The importance of HIV prevalence points to mechanisms that link intimate partner violence and HIV through increased infection risk of one or both spouses outside of marriage, by contrast with increased risk of transmission between spouses caused by intimate partner violence.[12] Moreover, many observations might be needed when prevalence is low, since low variation in the dependent variable makes estimates less precise: as mentioned, very few point estimates of the adjusted odds ratios are lower than 1. After all, the HIV epidemic is dynamic: many factors affect the risk of being infected by the virus. Additionally, collection of data about intimate partner violence and HIV infection is challenging, and we have little information about the context in which intimate partner violence occurs or how regular it is in a given relationship.

Panel: Research in context

Systematic review

We did not do a systematic review of the scientific literature because several comprehensive surveys exist.[5,16,17] The most recent survey[5] found 101 studies about the association between intimate partner violence and HIV, of which 45 use data from Africa. Most of these studies are cross-sectional studies that use small samples, and only a small proportion are population-based. Six studies used national survey data from various sub-Saharan African countries.[4,6,10,11,18,19] None reported significant adjusted odds ratios for physical and sexual violence; two showed that emotional violence was associated with HIV, using the Rwanda 2005 Demographic and Health Survey;[6,11] one showed an association between a combined measure of physical, sexual, and emotional violence and HIV, using the Kenya 2008–09 Demographic and Health Survey;[10] and one showed no effect of sexual power on HIV in South Africa.[19] Four studies about sub-Saharan Africa used longitudinal data.[2,20–22] Two are from Rakai in Uganda, one of which reported that women exposed to intimate partner violence are 55% more likely than other women to get infected within 1 year,[20] whereas the other[22] showed no statistically significant association. A third study[23] did not show that intimate partner violence increases the risk of infection in a sample of HIV-discordant couples in eastern and southern Africa, although already infected women were more likely to report intimate partner violence than those who were not infected. The fourth study is Jewkes and colleagues' report[2] of young women in South Africa, which reported that one in seven HIV infections were attributable to intimate partner violence.

Interpretation

Our results corroborate evidence from much of the published literature of an association between intimate partner violence and HIV infection, and the size of the odds ratios (1·1–1·7) are in line with those of Jewkes and colleagues' study.[2] However, they differ from earlier studies that used the nationally representative Demographic and Health Survey data. Three reasons exist for these differences: we use indicators of physical, sexual, and emotional violence combined with male controlling behaviour; we compare women exposed to a particular type of intimate partner violence versus women who report not being exposed to any type of intimate partner violence; and we estimate models with data from regions with high and low levels of HIV prevalence. The association is strongest in high-prevalence regions when the woman is exposed to male controlling behaviour, whereas there is almost never an association for violence that is not combined with controlling behaviour. One interpretation of this finding is that our indicator of controlling behaviour measures male dominance that is associated with frequent and ongoing violence, whereas violence without controlling behaviour is more often the result of quarrels in which both spouses might be aggressors. However, more research is needed to understand the role of controlling behaviour: it could be an indicator of severe violence or important in its own right. In the meantime, HIV prevention programmes should focus on intimate partner violence in high-prevalence areas, with a particular focus on male controlling behaviour.

Several reasons exist for the inconsistent findings in the earlier studies, three of which are addressed in this study. First, the correlation between the indicators of intimate partner violence is often ignored, so women exposed to one type of intimate partner violence are compared with a group in which some women are exposed to other types of intimate partner violence; thus, the control group is not clean. Second, the indicators of violence used contain both ongoing severe violence that is an expression of male dominance and violence resulting from conflicts between partners, in which both partners might be aggressors. Although our measures are narrow and far from perfect, we seem to be able to reduce some of this measurement problem by including male controlling behaviour. Third, as previously discussed, the probability of finding an association between HIV and intimate partner violence depends on the level of HIV prevalence in the community.

Our results differ from those of Harling and colleagues[4] because they used control groups that included women who report emotional violence and controlling behaviour, and focused on samples with either ever-married women or married women. Use of this approach with the six African surveys included in their study, or with all our surveys, results in insignificant adjusted odds ratios. However, when the control group is clean (as in our study), a statistically significant association exists between physical or sexual intimate partner violence and HIV infection.

As is the case with all observational studies, especially those into sensitive topics, this study has limitations. The use of cross-sectional data makes it challenging to control for relevant confounders. Nonetheless, many of the potential confounders that we did control for are highly significant, and substantial differences exist between unadjusted and adjusted odds ratios. Furthermore, the included confounders are all unlikely to be affected by intimate partner violence (appendix p 16). Another limitation of cross-sectional data is that we do not know whether HIV infection occurred after the acts of intimate partner violence or vice versa.

Not everyone eligible for HIV testing could or wanted to participate in the surveys, so a potential selection bias exists. The analysis of missing data in appendix pp 1–3 suggests that estimated associations between intimate partner violence and HIV could be biased downwards, but this conclusion is only tentative. Measurement error could also affect the estimated association downwards by creating attenuation bias.

Because we did tests using several indicators and many different samples, multiple testing, with an increased probability of obtaining false-positive results (type I errors), could be a concern. However, our samples and indicators are not independent, so adjustment of significance levels is not straightforward. Use of the Bonferonni correction as an approximation gives a significance level of roughly 0·001, but it assumes no true positives, that the tests are independent, and that only one false-positive result is accepted at the 0·05 level for all tests.[23] Therefore, the correction makes it far too difficult to reject the null hypothesis, but provides an indication that we have several true positives. Moreover, the study is set up to compare associations under different conditions, and we do not base our conclusions on single test outcomes, but on the general pattern.

This study provides additional support for the view that intimate partner violence is associated with increased risk of HIV infection by showing a strong association between the two variables in DHS data from various African countries. It also emphasises the importance of male controlling behaviour for the association—physical, sexual, and emotional violence without controlling behaviour seem to be of a different kind of intimate partner violence—and shows that the association probably depends on HIV prevalence in the neighbourhood. It therefore presents evidence in favour of HIV prevention programmes that focus on reducing intimate partner violence in high-prevalence areas.

Contributors

DD and AL both analysed the data and wrote the report.

Declaration of interests

We declare no competing interests.

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